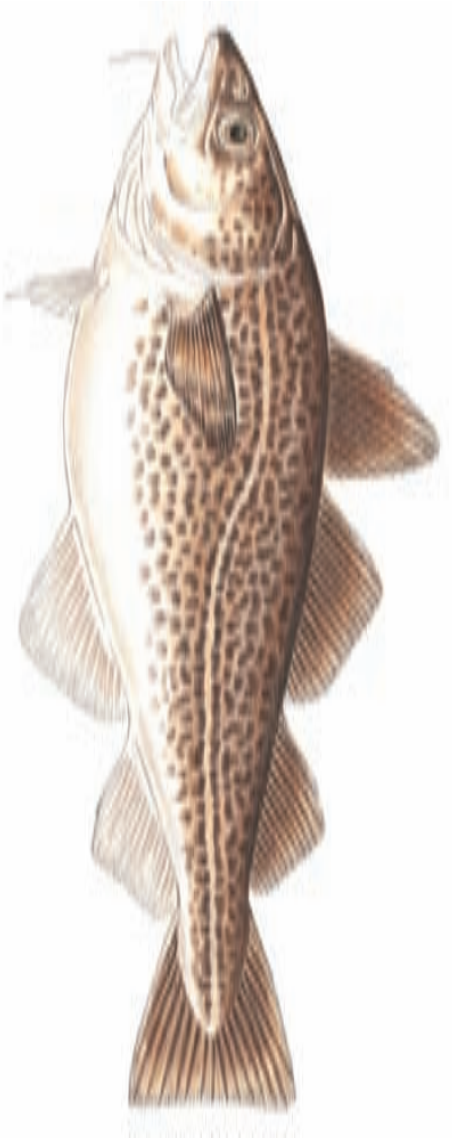
MarineFisheries *at sea*

MASSACHUSETTS DIVISION OF MARINE FISHERIES

Massachusetts Coastal Waters

Map Courtesy of Tracy Pugh

Introduction



The Massachusetts coastal environment contains some of the nation's richest habitat for marine fisheries resources. Significant stocks of migratory fish, including striped bass, Atlantic bluefin tuna, and menhaden traditionally make Massachusetts waters their summer home. Atlantic cod, haddock and flounders have been harvested from the northwest Atlantic for over a thousand years by many foreign nations, but fishing boats from Gloucester and New Bedford, Massachusetts have always been leaders in providing the world a healthy supply of fresh fish.

The Commonwealth's commercial and recreational fisheries today continue to obtain major benefits from our unique coastal environment, but very specific threats to fish populations and fish habitat exist. Overfishing is one threat that is managed directly by federal, interstate, and state processes that strive to maintain sustainable fishing practices. Growing competition for use of our coastal resources, including traditional and alternative power generation, desalination of sea water, and ocean mining, as well as ballooning coastal development, adds to the challenge of maintaining environmental capacity at levels high enough to support an abundance of biologically diverse living resources.

To generate better scientific information for fisheries management and coastal habitat protection, to help identify essential fisheries habitat and species of critical concern, and to provide valuable advice to cities and towns involved in local management of fisheries resources it is important that the Division of Marine Fisheries (*MarineFisheries*) conducts both cutting edge and routine research. The Division's work also includes technical assistance and the dissemination of broad educational information to fishermen, regulatory agencies, municipal Conservation Commissions and members of the general public.

We are a small research/regulatory division of state government with responsibility and authority to manage the Commonwealth's marine fisheries resources. I hope you find this brief presentation of some of the activities being conducted by *MarineFisheries* informative.

Very Sincerely,

Paul Diodati

Paul Diodati
Director

Management of Marine Fisheries

The Massachusetts Division of Marine Fisheries (*MarineFisheries)* is the Commonwealth's chief fisheries management agency. Guidelines for managing marine fisheries comes through Chapter 130 of Massachusetts General Law, the Atlantic Coastal Fisheries Cooperative Management Act, the Interjurisdictional Fisheries Management Act and the Magnuson-Stevens Fishery Conservation and Management Act (MSA).

Fisheries often are identified and/or characterized with respect to state-federal jurisdictional boundaries, and as a consequence there are varied and dynamic biological, political and socioeconomic considerations for fisheries management. State-federal interactions have led to various combinations of authority with respect to fisheries management plans (FMP).

Some fisheries are conducted under a single FMP (either interstate or federal) or some combination of the two. Fisheries managed under dual FMPs are often termed joint-management and generally result in one of the jurisdictions taking a lead role. Involvement in governance of fisheries extends beyond state and federal authorities and includes industry stakeholders, environmental groups and other interested parties.

Authorities & Jurisdictions

State and federal fisheries management jurisdictions and authorities are based upon the split between sovereign powers, yet the boundary certainly has been anything but set in stone. Section 306(a) (2) of the MSA extends some state fisheries jurisdiction, not sovereignty, into certain portions of the federal Exclusive Economic Zone (EEZ). It is by this exemption to federal jurisdiction that the Commonwealth gains direct fisheries jurisdiction in Nantucket Sound.

From left to right: MarineFisheries' R/V Alosa transits the Cape Cod Canal on its way to survey cod in Massachusetts Bay; SCUBA divers check gear compliance and remove ghost gear from the Cape Cod Canal; and biologist Bill Hoffman displays a lobster hauled aboard a leg of the Gulf of Maine Cod Industry Based Survey.

Commonwealth Fisheries Management

Massachusetts General Law Chapter 130 calls for the *MarineFisheries*' Director to adopt, amend or repeal regulations, subject to the approval of the Marine Fisheries Advisory Commission (MFC) and the Commissioner of the Department of Fish & Game, which shall govern the manner of taking fish, legal size limits, seasons and amount of fish to be taken. The Director represents the Commonwealth on both the Atlantic States Marine Fisheries Commission (ASMFC) & New England Fishery Management Council (NEFMC).

The MFC is a nine member board established by the Legislature in 1961. Members are "qualified in the field of marine fisheries by training and experience", representing conservation, recreational and commercial fishing interests and are appointed by the governor to three-year terms and attend monthly business meetings as well as quarterly public hearings on matters within *MarineFisheries*' jurisdiction.

Interstate Fisheries Management

In 1993, Congress formalized the current structure of interstate fisheries management with passage of the Atlantic Coastal Fisheries Cooperative Management Act (ACFCMA). The Act allows the Secretary of Commerce to place a moratorium on a state's fishery found out-of-compliance with an interstate fishery management plan that has been adopted by the Atlantic State Marine Fisheries Commission (ASMFC).

The ASMFC was formed by the 15 Atlantic coast states, the Potomac River Fisheries Commission, the District of Columbia and the two federal fisheries agencies in 1942 in recognition that fish do not adhere to political boundaries. It serves as a deliberative body, coordinating the conservation and management of the states' shared nearshore fishery resources.

From left to right: summer flounder; bluefish; scup.

Federal Fisheries Management

NEW ENGLAND FISHERY MANAGEMENT COUNCIL

In order to manage and conserve fish stocks, the MSA created eight regional fishery management councils that are overseen by the Secretary of Commerce (SOC). Each council develops fishery management plans (FMPs) for the stocks in their geographical region specifying how a fishery will be managed. These plans regulate, among other things, gear types, seasons, quotas, and licensing schemes.

The New England Fishery Management Council (NEFMC) is made up of eighteen voting members:

(1) The Regional Administrator of the National Marine Fisheries Service (NOAA Fisheries); (5) The principal state official with marine fishery management responsibility for Maine, New Hampshire, Massachusetts, Rhode Island and Connecticut; (12) Twelve members nominated by the governors of the New England coastal states and appointed by the SOC, each serving no more than three consecutive terms. In addition, four non-voting members represent the United States Coast Guard, U.S. Fish and Wildlife Service, U.S. Department of State, and the ASMFC.

Before the federal government approves and implements FMPs developed by the NEFMC, it must ensure all plans meet 10 National Standards set forth by the MSA. Litigation based on meeting these standards has increased significantly over the years and has led to what many view as the inflexibility of fisheries management.

MarineFisheries At Sea

Conservation Engineering

Conservation Engineering develops and tests modifications to commercial fishing gear and innovative designs that minimize impacts on non-target species and habitat. Reducing the take of unwanted catches in fishing gear helps to keep fish stocks healthy, improves efficiency and profitability, and promotes responsible fishing. We use underwater cameras to record behavior of fish to fishing gear. Performance of scale models of fishing nets in flume tanks also is commonplace in conducting this work. Most of our research, whether with lobster traps, fish pots, longline hooks, trawl nets, gillnets, scallop dredges, or other gear is done cooperatively. We rely on fishermen to identify areas of concern, to help design modifications, to test gear on the water, and to encourage wider use of effective modifications.

MarineFisheries biologists check experimental gear before an at-sea trial.

Fisheries Dependent Investigations

MarineFisheries conducts monitoring of catch and bycatch composition of some of the state's fisheries. Biologists go to sea with fishermen to collect commercial and recreational fisheries data and biological samples for research and to document fishery performance. Primary fisheries covered include pot fisheries for lobster, sea bass, and scup;

MarineFisheries staff collect valuable information from fishermen on catch rates and effort in local fisheries that helps to develop appropriate regulations and managment plans.

trawl fisheries for squid, whiting and groundfish; hook-fisheries for cod, spiny dogfish and scup; gillnet fisheries for groundfish and spiny dogfish; and head-boat fisheries that serve recreational fishermen catching many species including bluefish, cod, haddock, scup and black sea bass.

Industry Based Surveys

During 2003-2007, *MarineFisheries* conducted a federally funded pilot program using commercial draggers to survey for Atlantic cod in the western Gulf of Maine. NOAA Fisheries provided $1.5-million to conduct survey cruises using four commercial vessels fishing standardized bottom trawls. An important part of survey design was selection of stations by fishermen and their involvement in determining the numbers of sampling

MarineFisheries conducts several fishery surveys aboard cooperating commercial fishing vessels.

stations. This effort was coordinated by the NOAA's Cooperative Research Partners Initiative (CRPI) with its objective of "collecting data that will improve our knowledge of fish populations and incorporate these data into an expanded information base for monitoring of existing and developing new fishery management strategies." In total, the study completed 17 cruises comprising 1,904 survey tows and measured over 83,000 cod.

Lobster Investigations

MarineFisheries conducts sea sampling aboard commercial lobster boats each year. This project began in 1981 and collects biological and catch/effort data from six coastal regions during the major part of the lobster fishing season, May-November. A second annual sampling effort for early benthic phase/juvenile lobsters is conducted by SCUBA through suction sampling the ocean floor in order to generate density indices of newly settled post-larval lobsters (since 1995). This effort also delineates coastal habitat important to juvenile lobster. Year-round bottom temperature monitoring (since 1988) is conducted with programmable electronic recorders at various depths at seven coastal

Early benthic phase lobster.

sites north and south of Cape Cod; recorders are replaced annually by SCUBA. Data from two additional projects also contribute to stock evaluations. These include *MarineFisheries* Statistics Project, which collates catch reports submitted by commercial fishermen to provide landings and effort statistics on a monthly and area basis (since 1967), and the Resource Assessment Project, which provides, through a bottom trawl survey, relative abundance information on lobster and other species (since 1978). Time series data generated by these sampling efforts together with those from other states and NOAA Fisheries allow us to contribute to Atlantic-wide assessments of lobster stock condition.

Northern Shrimp

MarineFisheries has been involved with monitoring and management of the western Gulf of Maine Northern shrimp resource and fishery since the early 1970s. These efforts include the collection of fisheries dependent and independent data for northern shrimp to

MarineFisheries staff gathers information on the northern shrimp fishery and resource during an annual survey aboard the R/V Gloria Michelle.

estimate biological and catch-per-unit effort parameters. In addition we participate on the annual state/federal Northern shrimp trawl survey. This research survey collects important fishery independent data which are used to generate abundance indices for adult and juvenile shrimp used in stock assessments. Results of the stock assessment are used to provide advice to fisheries managers who set annual shrimp fisheries regulations. Our comprehensive approach, which integrates data collection, data analysis/assessment, and fisheries management, has helped make ASMFC's Gulf of Maine Shrimp Management the longest running interstate fisheries management program in the country.

Shellfish Sanitation & Management

MarineFisheries has two primary missions regarding shellfish: public health protection and management of the Commonwealth's molluscan shellfish resources. Public health protection is afforded through the sanitary classification of all 1,745,723 acres of overlying waters within the states territorial sea in accordance with the provisions of the National Shellfish Sanitation Program (NSSP) which is recognized by the U.S. Food and Drug Administration and the Interstate Shellfish Sanitation Conference for the sanitary control of shellfish produced and sold for human consumption. Water and shellfish samples are tested for fecal coliform bacteria and various deleterious substances.

Public health protection is achieved as a result of sanitary surveys of shellfish growing areas to determine their suitability as shellfish sources for human consumption. Another major aspect of the shellfish program involves monitoring for naturally occurring marine biotoxins commonly known as "Red Tide,"

MarineFisheries shellfish biologists routinely monitor phytoplankton to ensure sustainable and healthy shellfish fisheries.

Bagged shellfish for depuration.

whose consumption at certain levels can produce severe illness and even cause death. Shellfish are sampled weekly from March through mid-November to determine the levels of toxin. If toxin levels exceed safe limits, fishing areas are closed. In addition to bioassays of shellfish, monitoring of phytoplankton is conducted to provide early warning of potentially toxic phytoplankton blooms.

Shellfish management is accomplished by direct regulation, harvest of contaminated shellfish for depuration and relaying, size and maximum harvest limits of other shellfish, bay scallop and conch seasons, shellfish aquaculture and collection of statistics. Clams harvested from specially designated, conditionally restricted areas of Boston Harbor are transported by licensed and bonded master diggers under strict enforcement to our Shellfish Purification Plant in Newburyport, the oldest and largest continually operating depuration facility in the country. The plant is open 364 days a year and processes an average of 560 bushels of soft-shelled clams a week.

Resource Assessment

The Resource Assessment Project collects and analyzes data to contribute to fisheries management. Coastal and estuarine species found in Massachusetts' territorial waters vary widely in abundance and diversity. Fish are sampled using standardized spring and fall surveys of Massachusetts' territorial waters using an otter-trawl. Surveys are timed to coincide with seasons when either adults or juveniles are available inshore.

Sample of juvenile cod.

Onboard NOAA's R/V Gloria Michelle, *MarineFisheries* aims to obtain fishery independent data on the distribution, abundance, size and age composition of finfish as well as some crustaceans and mollusks. Staff prepares scientific reports and gives technical presentations to fishery managers for use in developing policies governing the use and protection of fishery resources.

Stock assessment analyses rely on various sources of information in addition to surveys to estimate resource abundance and trends. The principle information comes directly from recreational and commercial fisheries. Fishery-independent surveys operate differently from other types of fishing. While other fishing operations seek out the greatest aggregations of fish to maximize catch rates, trawl surveys fish in a standardized manner over a wide area to annually provide an unbiased population abundance index. Our survey is based on a stratified random design that uses five bio-geographic regions. We divide each region into depth zones called strata. About 100 stations from each survey are allocated based on approximate proportion of each stratum's area.

Although the trawl survey captures about 90 different species each year, project emphasis has been directed toward sampling some of the state's most important finfish resources. These include winter flounder, summer flounder, Atlantic cod, scup and black sea bass.

Striped Bass Research

Massachusetts is currently home to the largest recreational striped bass fishery in the country. Our total catch of stripers in 2006 alone was about 9 million fish. Striped bass

State Senators O'Leary, Tarr and Panagiotakos lend their assistance to a tag-and-release project.

are the backbone of our recreational industry and provide enjoyment to hundreds of thousands of recreational anglers each year, so we conduct many special investigations and monitoring programs designed to support the regional planning process such as age and growth sampling, tagging studies and diet and bioenergetics. Annual sampling is conducted for age and growth research of the commercial harvest at seafood dealerships. Information collected from more than 9,500 stripers beginning in 1982 includes length, weight, sex, and scales from each fish examined. Since 2001, we have worked with dozens of volunteer recreational anglers to collect scales to boost our sampling coverage. We can observe annual "growth rings" on fish scales and use them to estimate age composition of the catches and rate of growth.

MarineFisheries began a striped bass tagging study in 1991 as part of an ongoing state-federal cooperative effort and has tagged and released over 5,000 fishes. Our study furnishes the largest proportion of legal-size fish to this overall effort. Striped bass tagged in Massachusetts' waters have been recaptured as far north as New Brunswick, Canada and as far south as Georgia, USA.

Recreational striped bass angler.

Research has provided valuable information on striped bass' diet and bioenergetics through building a computer-based bioenergetic model that allows us to estimate consumption rates of striped bass for any particular food item, such as river herring, menhaden, and even the commercially important lobster as a result of underweight striped bass catches. *MarineFisheries* collected diet information from over 3,000 striped bass collected from the North Shore, Cape Cod Bay, and Nantucket Sound regions of Massachusetts.

Anadromous Fisheries Restoration

Massachusetts is home to almost 100 river herring spawning runs. *MarineFisheries* has an extensive program to sample many of these populations for such key factors as abundance, sex ratios, and age struture. Analysis of age data indicate that mortality of our river herring populations is very high and this is likely contributing to the severe decline seen in recent years.

MarineFisheries staff stocking smelt in the Crane River.

A *MarineFisheries* survey of fish passage along the Massachusetts coast identifies sites where anadromous fish are impeded or blocked from reaching their spawning grounds. This survey forms the basis of a list of priority construction/repair projects for new and existing fish passage structures.

MarineFisheries has recently completed repairs and improvements on several fish ladders in the Charles River in preparation for the return of American shad. Over 1 million American shad fry have been stocked each year into the Charles in order to restore a sustainable population for the first time in over 100 years. Rainbow smelt have also been the target of restoration efforts. Over 4 million larval smelt have been stocked into the Crane River in Danvers in an effort to restore the spawning population in that area.

Tournament Monitoring

Well-founded fisheries management decisions must be based on a thorough understanding of the fisheries themselves. Sportfishing Tournament Monitoring provides valuable information about our fisheries that contributes to such a foundation. Extensive offshore fisheries for big game fish like tunas, sharks, and marlin occur off our coast from June through October each year. Recreational anglers in private and chartered vessels travel miles offshore to catch bluefin, yellowfin, albacore, and bigeye tunas, blue, mako, and thresher sharks, and blue and white marlin. Since 1987, *MarineFisheries* biologists have harnessed the efforts of tournament fishermen to learn about the species and size composition, basic biology, and relative abundance of big game fishes off our

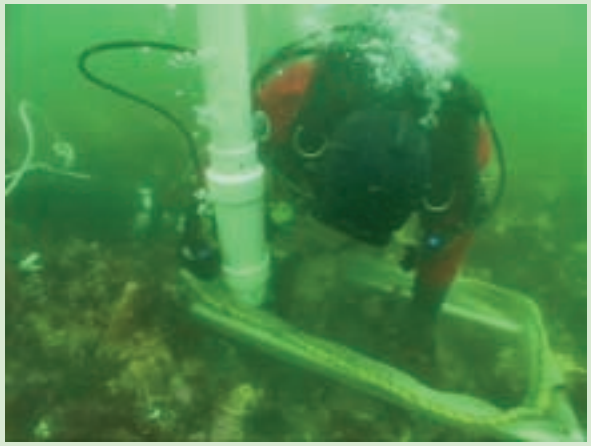
Massachusetts plays host to several fishing tournaments drawing numerous fishermen and boats.

coast. Offshore fishing tournaments not only provide catch data and biological samples but estimates of effort, which are often lacking for offshore recreational fisheries. The fishing effort collected at each tournament can be used to calculate estimates of relative abundance for each species.

MarineFisheries makes every effort to collect total tournament catch information, which includes not only fish that are landed but also those that are tagged, released, or lost. By working closely with tournament sponsors and tournament participants, *MarineFisheries* biologists not only assist in the development of the event but also facilitate complete data collection. This is particularly important when indices of abundance are used to monitor annual changes in fishing success.

Scientific Diving

The use of diving, specifically with SCUBA, to collect or directly observe marine organisms *in situ*, is a recognized, scientifically valid technique. No other tech-



A MarineFisheries SCUBA diver collects a suction sample.

nique currently in use gives the researcher the resolution afforded by direct observation, or the ability to observe behavior without the limitations imposed by laboratory experiments. *MarineFisheries* established a Scientific Diving Program in the late 1970s to ensure that all scientific diving is conducted so as to promote the protection of divers from accidental injury and/or illness, and to set forth standards for training, certification, and diving operations.

Shark & Large Pelagic Research

The Shark Research Program was established in 1990 to study the ecology, distribution, and relative abundance of sharks that are subject to recreational fisheries in the Commonwealth. In addition to fieldwork, the project also provides public education and technical information on the biology, management, and use of sharks. Biologists conduct cooperative research with other world-renowned shark researchers to provide local expertise and biological samples for these cosmopolitan, highly migratory predators.

A substantial recreational fishery for sharks occurs in Massachusetts from June through September each year. Although many recreational fisherman target sharks, most of those caught are released alive. Not only are sharks an important component of the Massachusetts recreational fishery, but sharks are currently fished as a sustainable resource.

Basking shark.

MarineFisheries biologists analyse blood samples from hook and line caught billfishes, tunas, and sharks. The results indicate that many species experience large metabolic changes in response to the "fight", sometimes resulting in the death of individual fish or long recovery periods.

About 50 high-tech satellite tags have been put on basking, porbeagle, and sand tiger sharks from Massachusetts waters. These tags collect data for about a year while attached to the shark, and then release, float to the surface, and transmit their data to passing satellites. Information supplied from these tags has documented the behavior and extensive migrations of these animals.

Protected Species Conservation Project

MarineFisheries works to protect marine protected species such as endangered turtles and large whales. Since 1997, the Right Whale Conservation Program has worked to minimize harm to Northern Right Whales in state waters, including the Right Whale Critical Habitat in Cape Cod Bay. *MarineFisheries*' efforts dovetail with ongoing federal, state and private programs to protect Right Whales.

Our efforts include research, management, and education components. The keystone of the program is the Surveillance and Monitoring Program, where experienced researchers from the Center for Coastal Studies (CCS) and biologists from *MarineFisheries*, survey and monitor Northern Right Whales and their habitat in Cape Cod Bay Critical Habitat and adjacent waters. Scientists study the Right Whales' habitat by monitoring plankton, water temperature, salinity, and much more to better understand and forecast for the presence/absence and movement patterns of Right Whales. The program contributes sightings of Right Whales to the federal Sighting Advisory System, which warns mariners of the presence of Right Whales in order to reduce the threat of ship strikes.

MarineFisheries began a collaboration in 2003 with Dr. Christopher Clark of Cornell University's Bioacoustic Lab to establish acoustic monitoring stations in Cape Cod Bay. This real-time acoustic monitoring system detects right whale vocalizations and relays that information in near real-time via cell phone. Older buoys were relatively noisy and caused false detections due to the motion of the hydrophone in the water column. These new listening stations will allow us to monitor right whales in near real-time and over a broader time frame to better manage the species and address potential threats.

To prevent or reduce the threat and harm from entanglement with fixed fishing gear, *MarineFisheries* gear experts work with fishermen to modify fishing gear and practices so that they are "whale-friendly", yet remain safe and productive for fishing. Massachusetts lobstermen have taken the lead by being the first in the nation to replace floating line with sinking line connecting traps thereby removing most of the entanglement risk to large whales, including the endangered humpback and fin whales.

While this gear modification is beneficial to endangered and threatened whales, it does create a burden for the fishing industry. Many lobsterman have reported that sinking line wears much faster then floating line because of contact with the sediment.

In response, *MarineFisheries* began working with industry to simulate the wear groundline experiences in the field in a shorter period of time by using a line testing machine. Currently, industry is in its second year testing the best performing lines at-sea.

Humpback whales surface off mid-coast Massachusetts.

All photos by DMF Staff excluding underwater basking shark photo, courtesy of Nick Caloyianis.

MarineFisheries *at sea*

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MarineFisheries receives state and federal funds to conduct research, management and development of the Commonwealth's marine fishery resources.

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